On irregular singularities of algebraic connections

Let E be an algebraic flat connection on a smooth complex algebraic variety X, let $\overline{X}$ be a smooth compactification of X such that $D := \overline{X}\backslash X$ is a normal crossing divisor. Levelt-Turrittin theorem asserts that the pull-back of E to the formal neighbourhood of a codimension 1 point in D decomposes (after ramification) into elementary factors easy to work with.

This decomposition may not hold at some other points of D, but when it does, we say that E *has good formal decomposition along* D. A conjecture of Sabbah, recently proved by Kedlaya and Mochizuki independently, asserts the existence of a chain $p : Y \longrightarrow \overline{X}$ of blow-ups above D such that E has good formal decomposition along $p^{-1}(D)$.

In a sense, this result is to flat connections what Hironaka desingularization is to varieties, and has recently allowed ground-breaking progresses in our understanding of $\mathcal{D}$-modules. The goal of this course is to introduce the concepts at stake in the statement of Kedlaya-Mochizuki theorem, and to give an application to the existence of periods for arbitrary algebraic flat connections.

No prerequisite on $\mathcal{D}$-modules is necessary to follow this course.

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